psycho-physics. Weber's law was the first definite discovery of the fact on which the quantum theory rests. He discovered that in sensible experience changes are not continuous—that is, do not correspond to the continuity of the changes of the physical stimulus, but occur in discrete quanta. He was a parallelist, and thought that changes in the physical environment were concomitant with changes in sensation. He never suspected, probably would have found it difficult to conceive, that changes in the physical world are discrete. Planck's quantum theory is the discovery that the same fact which Weber found to characterise the psychical world characterises the physical world; that energy is emitted, not continuously, but in discrete quanta; that, as Lord Haldane says, we may even have to regard space as a discrete manifold. This comparison is not a fanciful notion, nor purely imaginary. The whole problem was discussed by Henri Poincaré in "Science et Hypothèse" before Planck's discovery. Poincaré cites Weber's law as actual proof that the concept of mathematical continuity is only a postulate, declares that it is unverifiable, and suggests that it may be disproved or superseded. This is peculiarly significant in regard to Lord Haldane's concept of the concrete universal, the concept that reality is relative to the character of knowledge.

The practical gain in such a concept when we are dealing with biology and with the mental sciences is the topic of chap. vi. of the book. The most striking thing about the new scientific revolution is the havoc it is making of the once unchallengeable and universally accepted notions at the basis of the purely mathematical sciences. It is not, for example, Newton's law of inertia, primarily and mainly based on empirical observation, which is suspect. It is the much more fundamental law, the law of the equivalence of action and reaction, a purely rational principle, which seems now to be on its trial. The whole direction of scientific speculation in the nineteenth century was towards the conscious goal of mechanical interpretation. Scientific advance was practically identified with the confident anticipation that all the biological and mental sciences, even including such purely human interests as art and religion, would be mechanistically explained. The new spirit and the new direction in scientific speculation at least recognise that the abstract can never comprehend the concrete; and this recognition more than anything else is bringing about the *rapprochement* between science and philosophy, so long and so unreasonably estranged.

H. WILDON CARR.

A New Book on Cactaceæ.

The Cactaceae. By N. L. Britton and J. N. Rose. Vol. ii. (Publication No. 248.) Pp. vii+239+40 plates. (Washington: The Carnegie Institution of Washington, 1920.)

ALL cultivators of cacti and all botanists who are interested in this remarkable family of plants will feel satisfaction in knowing that at last we have in the English language a standard up-to-date monograph of the natural order Cactaceæ, which is universally recognised as being the most difficult of all flowering plants to study. With the exception of a few scattered but excellent papers upon them by Drs. Britton and Rose, Dr. Engelman, and Berger, this is the first work in the English language that gives a complete account of the order as we know it to-day. This fine book is so excellently planned and so fully illustrated as to be a long way in advance of the very unsatisfactory German works that have hitherto held the field, and will be found to be a real boon to all who study these plants.

From the introduction to the first volume (a notice of which was published in NATURE for September 11, 1919) we learn that Drs. Britton and Rose at first intended to monograph only the Cactaceæ of North America, but, happily, upon a proposal made by Dr. D. T. MacDugal, the plan was extended to include the whole of the family. Extensive preparations were made and a large army of workers was enlisted to collect and photograph the species in their native habitats, the result being that the authors have had at their disposal a larger amount of living and other material, accompanied by field-notes, drawings, etc., than any other students of this group have ever been able to obtain. As the types (when existing) of the older as well as of modern species have also been consulted, the authors have been able to detect and correct many errors of determination that are found in existing monographs.

Vol. ii. is of quarto size, well printed and profusely illustrated with photographs, drawings, and coloured plates, which, it is a pleasure to note, are nearly all originals. There are good keys to the tribes, subtribes, genera, and species, so that, taking into account the aid afforded by the figures, there should be no great difficulty in naming cultivated specimens when in flower.

Each tribe, subtribe, and genus is separately characterised, and the type of each genus indicated. Under each species the synonyms, with the date of their publication, a description, men-

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tion of the type locality, the general distribution, references to illustrations, and general notes are given. All the descriptions are in English, and written in a correct but very simplified style, so that anyone can easily understand them. Latin descriptions find no place in this admirable work, which is designed to be useful to the multitude rather than to the botanist alone.

In the first volume the Cactaceæ are divided into the three tribes Pereskieæ, Opuntieæ, and Cereæ. The tribe Pereskieæ contains only the single genus Pereskia, of which nineteen species are described. The Opuntieæ are divided into seven genera, of which Opuntia is the largest, containing 240 species; the other genera have only one or a few species in each. These two tribes fill the first volume, and the Cereæ, which comprise the bulk of the order, are being dealt with in the remaining volumes. The first portion of the Cereæ is accounted for in the present volume, where the plants that are commonly known by the generic title of Cereus are described and illustrated.

It has long been recognised that different species of Cereus produced different types of flower, and since, in other natural orders, differences in floral structure are recognised as being of generic value, some botanists have founded genera upon some of the different floral types found among Cerei. These genera have not hitherto found much favour among botanists or horticulturists, because the plants, when not in flower, often present a great similarity to one another. The authors of "The Cactaceæ," however, have accepted the view that a difference in floral characters should constitute a generic distinction; they have had this view constantly in mind, and carried it to a logical conclusion, so that they have divided the old genus Cereus into no fewer than forty-seven genera, containing 275 species. Twenty of the genera are proposed for the first time in this volume. Whilst there can be little doubt that the plants which have been placed in the genera Heliocereus, Aporocactus, Cleistocactus, etc., should be separated from Cereus, it may be questioned whether those placed in the genera Dendrocereus, Harrisia, Acanthocereus, etc., should be held to constitute more than sectional groups under Cereus. This, however, is a matter of opinion, and time alone will show if the numerous genera maintained in this work will be generally accepted. Whether they are accepted or not, their adoption in "The Cactaceæ" in no way invalidates the usefulness of that splendid work. The reviewer has had considerable experience in the use of existing monographs, and has found "The Cactaceæ" very far in advance of them; it can be recommended with confidence to students.

The only noticeable fault in the work is the rather serious one that exceptions are always neglected in the keys. This, however, is a fault appertaining to most botanical works, and invariably leads the novice astray. For example, should a novice desire to find out, by means of the key given on p. 1 of vol. ii., the subtribe in which the authors place the globose, spineless plant cultivated under the name *Echinocactus* (and *Anhalonium*) *Williamsii,* no place for it will be found. The only spineless plants mentioned in that key belong to the subtribe Epiphyllanæ, which have flat, many-jointed stems. This fault is so easily remedied by including exceptions and variable characters again and again under the headings of different parts of the key that perhaps the authors will endeavour to correct this defect in the continuation of their work. They are to be congratulated heartily upon the manner in which they have so far carried out their very difficult task of evolving order out of the very confused synonymy found in other works upon this group of plants.

N. E. BROWN.

A Study in Geo-chemistry.

The Enrichment of Ore Deposits. By W. H. Emmons. (Bulletin 625. United States Geological Survey: Department of the Interior.) Pp. 530. (Washington: Government Printing Office, 1917.)

UNDER the above modest guise the United States Geological Survey has published a volume of the greatest value to the student of ore deposition, which may fairly claim to rank as one of the most interesting of recent contributions to this very difficult branch of economic geology. The author points out that two phases in the formation of economically important ore deposits require independent investigation, namely, the formation of the primary ore deposits and the subsequent modifications which the more superficial portions in many cases undergo.

The present work is devoted exclusively to a comprehensive investigation of the second of these phases, the genesis of the primary ore deposits being considered indirectly only. The author reviews successively the conditions that make for enrichment, such as amount of rainfall, surface contours, permeability of the rocks, the nature of the underground circulation of water, and in particular the oxidation of sulphide deposits. He lays very great stress upon the last-named, and ascribes the solution of the various minerals

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